PCT/AU03/01585

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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002952984 for a patent by SCOTT ALLMAN, JAMES SAMMONS and CHRIS MURRY as filed on 28 November 2002.

WITNESS my hand this
Eleventh day of December 2003

J. Billingsley

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P/00/009

Regulation 3.2

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: FORCED ENTRY SYSTEM

The invention is described in the following statement:

Our Ref: 021043

FORCED ENTRY SYSTEM

The present invention relates to systems and methods adapted to gain forced entry into buildings and structures in situations where such entry is required for military or law enforcement purposes and where such entry is denied.

BACKGROUND

In both military and law enforcement operations it may become necessary to gain forced entry into buildings where such entry by normal means is denied. Some examples of such situations may include the rescue of hostages or the interdiction of serious criminal activity. In such situations the more conventional means of forced entry by the use of rams or sledge hammers and the like may be rendered ineffective by the particular structural or barricaded entry conditions of the building.

In such situations the only recourse may be to use explosive entry techniques. These are high risk operations, with known methods making use of metal fragments to effect penetration at the desired point of entry, with risk of injury to the occupants of the building, or even of the operational personnel.

It is an object of the present invention to offer systems of forced entry using explosive means in which the

explosive effect is limited to an extremely short range, or otherwise addresses or ameliorates the above disadvantages.

BRIEF DESCRIPTION OF INVENTION

Accordingly, in one broad form of the invention, there is provided an elongate explosive charge element, said explosive charge element including a flexible frangible cutting sheet, said charge element adapted to the penetration of a barrier structure.

Preferably said cutting sheet is comprised of a matrix of polymers including plasticisers, stabilizers and flexible agents, said matrix containing a substantially uniform distribution of powdered material.

Preferably said powdered material is selected singly or in combination from a group of metals and ceramics, said group of metals including copper, aluminium, brass and ferrous metals.

Preferably said cutting sheet is formed by an extrusion process.

Preferably said cutting sheet is formed by a casting process.

Preferably said cutting sheet is associated with an explosive agent.

Preferably said explosive agent is in sheet form laminated to said cutting sheet, the lamination comprising an explosive agent layer and a first cutting sheet layer.

Preferably said lamination of said cutting sheet and said explosive agent layer are formed so as to produce a shaped charge effect when combined with a stand-off material; said charge effect having the general behavioral characteristics of the "Monroe Effect".

Preferably said lamination of said first cutting sheet and said explosive agent layer is combined with a second layer of cutting sheet so as to substantially envelop said explosive agent layer and said first cutting sheet; said second layer acting as a tamping layer.

Accordingly, in another broad form of the invention, there is provided an elongate explosive charge element, said explosive charge element including a flexible frangible explosive cutting sheet, said charge element adapted to the penetration of a barrier structure.

Preferably said explosive cutting sheet is comprised of a matrix of polymers including plasticisers, stabilizers and flexible agents, said matrix containing a substantially uniform distribution of powdered material, said matrix further containing a distribution of explosive agent.

Preferably said powdered material is selected singly or in combination from a group of metals and ceramics, said group of metals including copper, aluminium, brass and ferrous metals.

Preferably said explosive cutting sheet is formed by an extrusion process.

Preferably said explosive cutting sheet is formed by a casting process.

Preferably said explosive cutting sheet is formed so as to produce a shaped charge effect when combined with a stand-off material; said charge effect having the general behavioral characteristics of the "Monroe Effect".

Preferably said explosive cutting sheet and said stand-off material is combined with a layer of flexible frangible cutting sheet, said flexible frangible cutting sheet acting as a tamping layer.

Preferably said charge element is provided with a metal liner.

Preferably said metal liner is combined with laminations of said flexible frangible cutting sheet and said explosive agent; said metal liner acting a penetrating agent; said cutting sheet acting as a tamping agent.

Preferably said laminations of said cutting sheet, said explosive agent and said liner, when combined with a

stand-off material act as a shaped charge with the behavioral characteristics of the "Monroe Effect".

Preferably said metal liner is combined with laminations of said flexible frangible explosive cutting sheet; said metal liner acting as a penetrating agent; said explosive cutting sheet acting as a tamping agent.

Accordingly, in yet another broad form of the invention, there is provided a charge carrier adapted to support elongate explosive charge elements, said charge carrier adapted to the penetration of a masonry wall.

Preferably said carrier is comprised of a frame having a generally rectangular perimeter and at least one cross member, the members of said frame and cross member formed of hollow section polymeric material.

Preferably said frame members have an outer face provided with a channel extending the length of said members; said channel adapted to accept said elongate explosive charge element as an insert.

Preferably said frame perimeter and said cross member form a sealed container adapted for the retention of a tamping fluid; said sealed container provided with apertures and closure means for the filling of said tamping fluid.

Preferably the internal surfaces of said sealed container are pre-coated with a gelling agent adapted to modify said tamping fluid into a tamping gel when said fluid is added to said container.

Preferably said frame is provided with foot elements adapted to provide a height adjustment facility to said perimeter frame.

Preferably said frame is provided with an adjustable hinged support brace, said brace attaching to the rear face of a cross member.

Preferably said frame is provided with a plurality of charge ports on the rear face of said frame members.

Preferably said elongate explosive charge element is a composite layered and shaped assembly of flexible frangible cutting sheet and an explosive agent.

Preferably said elongate explosive charge element is a composite layered and shaped assembly of flexible frangible explosive cutting sheet and an explosive agent.

Preferably said explosive charge element includes a shaped metal liner.

Accordingly, in yet a further broad form of the invention, there is provided a charge carrier adapted to support an elongate explosive charge element adapted to

effect a directed explosive charge for the penetration of a barrier in which the penetrating agent is a fluid.

Preferably said barrier is comprised of structures including domestic and commercial metal roller doors, metal doors, fire doors, reinforced timber doors and glass doors.

Preferably said carrier is comprised of an elongate body of hollow section polymeric material.

Preferably said elongate body is provided with a sealing end cap at a first end and filler end cap at a second end.

Preferably said filler end cap is provided with an aperture and closure means adapted to allow the filling of said body with a tamping fluid.

Preferably said filler end cap is provided with a detonating cord grommet.

Preferably the internal walls of said body are pre-coated with a gelling agent adapted to modify said tamping fluid into a tamping gel when said fluid is added to said body.

Preferably said elongate body is provided with an adjustable foot element adapted to provide a height adjustment facility to said body.

Preferably said elongate body is provided with an adjustable hinged brace.

Preferably said body is provided with flexible magnetic strips disposed along portions of the front face of said body, said strips adapted to attach said charge carrier to a ferrous metal surface.

Preferably said elongate body is provided with internal guide rails adapted to accept a loading card as a friction sliding fit.

Preferably said loading card is an elongate polymeric extrusion having front and rear wall elements separated by transverse dividing elements so as to form a number of longitudinal passages through the length of said card.

Preferably said loading card is provided with a series of slots and holes disposed at each end of said card adapted to accept and retain a winding of detonating cord laid along the front face of said card so as to form an explosive charge element.

Preferably said explosive charge element is combined with a flexible frangible cutting sheet.

Preferably said explosive charge element comprises a frangible cutting sheet, the matrix of said cutting sheet containing a distributed explosive agent.

In yet a further broad form of the invention there is provided a method for the penetration of a barrier structure, said method including the steps of,

a. forming a flexible frangible cutting sheet by a process of extruding or casting in a suitable mould, a mixture of polymers including plasticisers, stabilizers, flexible agents and powdered metal or ceramics,

b. shaping said cutting sheet in combination with a layer of explosive agent and a stand-off material to form an elongate explosive charge element,

c. placing said explosive charge element in contact with said barrier structure and detonating said explosive charge element.

Accordingly, in yet a further broad form of the invention, there is provided a method for the penetration of a barrier structure, said method including the steps of.

a. forming a flexible frangible explosive cutting sheet by a process of extruding or casting in a suitable mould, a mixture of polymers including plasticisers, stabilizers and flexible agents, powdered metal or ceramics and an explosive agent,

b. shaping said explosive cutting sheet and combining said sheet with a stand-off material to form an elongate explosive charge element,

c. placing said explosive charge element in contact with said barrier structure and detonating said explosive charge element.

Accordingly, in yet a further broad form of the invention, there is provided a method for the penetration of a barrier structure using a charge carrier, said method including the steps of,

a. installing an elongate explosive charge element in said charge carrier,

b. filling said charge carrier with a tamping agent,

c. placing said charge carrier in contact with said barrier structure and detonating said explosive charge.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described with reference to the accompanying drawings wherein:

Figures 1A to 1L are cross sectional views of a variety of elongate shaped explosive charge elements according to a first embodiment of the invention.

Figure 2A to 2E are cross sectional views of a variety of elongate shaped explosive charge elements according to a second embodiment of the invention.

Figure 3 is a rear elevation view of a first embodiment of a charge carrier according to the invention.

Figure 4 is a side elevation of the charge carrier of figure 3.

Figure 5 is a cross sectional view of a member of the charge carrier of figure 3.

Figure 6 is a cross sectional view of the member of figure 5 with an elongate shaped explosive charge element installed.

Figure 7 is a rear elevation view and side view of a second charge carrier according to the invention.

Figure 8 is a cross sectional view of the charge carrier of figure 7.

Figure 9 is a front, side and end view of a loading card according to the invention.

Figure 10 is a detail elevation and plan view of a filling end cap of the charge carrier of figure 7.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In accordance with a first embodiment of a forced entry system, a principle component in this instance of which is a flexible frangible cutting sheet intended for use with explosive charges to cut through obstructing material. The structure of this sheet is made up of a polymer matrix including plasticisers, stabilizers and

flexible agents, containing a substantially uniform distribution of powdered metal. The metal may be any one of a selection of metals including for example, copper, aluminium, brass, ferrous metals, ceramics or a combination of these.

Preferably the particulate size of the metal or ceramic powder is in the order of 1 to 10 microns but both smaller and larger particles may be used. Different combinations of sheet thickness, particle density and particle size may be formulated depending on the explosive charge to be used and the nature of the barrier structure to be penetrated. That structure may comprise a wide range of materials including wood, metal, masonry, glass, polycarbonates and other plastics as well as composites.

The flexible nature of the cutting sheet enables it to be combined into a variety of elongate shaped charges when provided with an explosive agent. Desired shapes may also be achieved by extrusion, casting or fabricating.

By suitable shaping and the use of a stand-off material the cutting sheet may be adapted to take advantage of the "Monroe Effect" wherein the detonation of the explosive agent creates a high energy linear jet of gas. The stand-off material serves to provide that distance between the explosive agent and the target required for the

accelerating gas and particles of the cutting sheet to reach an effective penetration velocity. The stand-off material may be made of any light frangible material such as for example a polystyrene foam.

Figures 1A to 1L show a number of examples of preferred configurations of a cutting sheet (2), stand-off material (1) and explosive agent (3). As shown for example in figures 1A, 1C, 1G, 1H, 1I and 1J, an additional layer of flexible frangible cutting sheet (2) may be incorporated as a tamping layer.

It is a feature of the flexible frangible cutting sheet that the individual particles accelerated by the blast are of very low mass and thus lose energy rapidly from their initial high energy state after detonation of the explosive agent. As a result their penetration effect is limited to a very short range, thus minimizing fragmentation and the likelihood of unintended injury to any persons within the structure to be penetrated.

In an extruded form, the flexible frangible cutting sheet may be backed with a sheet explosive agent to obtain the desired cutting effect. Furthermore, extruded forms may be placed in a carrier adapted to incorporate a fluid tamping means, as is further set out below.

In a second preferred embodiment of the invention, the flexible frangible cutting sheet is itself loaded with an explosive charge to produce a flexible frangible explosive cutting sheet. As with the first embodiment this sheet may be formed by a variety of means including extrusion, casting and fabrication, and may be shaped and combined with a suitable stand-off material to produce a "Munroe Effect" discharge when detonated.

In a third preferred embodiment of the invention, either the flexible frangible cutting sheet or the flexible frangible explosive cutting sheet, may be combined in a variety of configurations with explosive agents and a metal liner, as shown in figure 2 in which (2) is a layer of flexible frangible cutting sheet or flexible frangible explosive cutting sheet, (3) is an explosive agent, (1) is a stand-off material and (4) is the metal liner.

In this embodiment it is the metal liner which acts as the cutting or penetrating agent with the cutting sheet providing a tamping effect and aiding the shaping of the "Monroe Effect".

All the embodiments of explosive charges described above may be used alone by direct application to the surface to be penetrated, or as charge elements of charge carriers according to the invention.

A first embodiment of a charge carrier (10) particularly adapted to the penetration of masonry walls, including single, double and cavity brick walls, concrete block walls and light formed concrete walls, is shown in figures 3 and 4. A perimeter frame (11) is formed of polymeric hollow section and includes at least one cross member (12). Carrier perimeter frame (11) is further provided with carry handles (13) and a telescopically adjustable hinged support brace (14). Height adjustment of the frame may be provided by means of foot elements (15) sliding in sleeves (16) and located at a preferred height by locking pegs (17) passing through a plurality of holes (18) in sleeves (16).

Arranged at intervals on the rear face (19) of frame (11), that is that face directed away from the masonry wall to be penetrated, is a plurality of charging ports (20) to allow for detonation of the explosive charge elements carried by the frame.

One preferred sectional shape of a perimeter frame (11) and cross member (12) is shown in figure 5. The front face (21) of the extruded sections, that is the face directed towards the object to be penetrated, is shaped with a holding channel (22) adapted to receive as a snap-fit pre-formed elongate charge elements of either the

flexible frangible cutting sheet or the flexible frangible explosive cutting sheet type as described above. The frame members may be extruded in a variety of cross sectional shapes and charge holding cavities to suit various operational conditions and charge element shapes.

Again with reference to figures 3 and 4, frame (11) is sealed and is provided with filler ports (23) and closure caps (24) allowing the frame to be filled with a tamping agent such as water. Optionally, frame (11) may be prepared at manufacture with a gelling agent so as to create a gel when the frame is filled with water to prevent leakage in the case of accidental fracture of the frame in an operational situation.

The frame charge element holding cavity (22) is preferably so configured as to obviate the need for the charge element to be provided with stand-off material; the required stand-off distance being provided by the frame itself as shown for example in figure 6. Here an elongate shaped charge (25) comprising flexible frangible cutting sheet (26) and explosive agent (27) has been fitted to cavity (22).

In a second preferred embodiment of a charge carrier according to the invention as shown in figure 7, carrier 100 is adapted to effect a directed explosive charge in

which water or other fluid acts as the penetrating agent. This second preferred embodiment is adapted in particular to any of a variety of door constructions, including commercial or domestic metal roller doors, metal doors, fire doors, reinforced timber doors and glass doors. It may also be used for some wall structures.

As shown in figure 7, charge carrier (100) has a main body (101) preferably formed of an extruded polymer section (as can best be seen in figure 8), although it may also be formed as a casting or fabrication. The composition of the polymeric carrier body (101) may include plasticisers to reduce brittleness. The carrier body (101) may be of any desired length depending on the intended application but is preferably in the range of 1.2 to 1.8 meters. Although a rectangular section is preferred, the body (101) may be square, triangular, oval or circular.

As shown in figure 8, the internal side walls (102) of body (101) are provided with guide rail elements (103). Body (101) is sealed at a first end (104) with a sealing end cap (105) and provided with a filler end cap (106) for closure at a second end (107). Filler end cap (106) is further provided with a filling port closure cap (108) and a detonating cord grommet (109) as shown more clearly in figure 10.

Sealing end cap (105) may be permanently assembled to body (101) during manufacture, while filler end cap (105) remains detachable until the carrier is prepared for use at a detonation site. Alternatively, both end caps may be supplied loose so as to allow detonation access to both ends of the carrier body.

Carrier body (101) may further be provided with an adjustable foot portion (110) to allow for height adjustment and a telescopically adjustable hinged support brace (111). Adjustable foot portion (110) may be formed of a sleeve of larger section than the sealing end cap (105) and be provided with a plurality of adjustment holes (112) for the insertion of suitable locking pegs (113). Additionally, carrier body (101) may be fitted with flexible magnetic strips (114) so as to allow for its attachment to metal surfaces.

Guide rail elements (103) are adapted to locate an explosive loading charge (120). In a first form as shown in figure 9, the loading charge (120) is comprised of a loading card (121) and detonating cord (not shown). Preferably, loading card (121) is in the form of a rectangular sectioned extruded polymer slat having front and rear wall portions (122) and (123) with a plurality of transverse divider portions (124) so as to form a number of

longitudinal passages (125) between the two wall portions, as shown in figure 8. The thickness of the card is such as to mate as a friction fit in rail elements (103). In one preferred form of the card (120) as shown in figure 9 the outer ends of the card are provided with slots (126) and holes (127) coinciding with passages (125).

In this form a desired length of detonating cord may be installed as lying along the face of the front wall portion (123) of the card, looping through the slots and holes so as to locate the cord to the card. Alternatively, the detonating cord may be threaded through the passages (125) and so winding about the front wall portion (122).

In use, a length of loading card is prepared with a length of detonating cord, lengths of both card and detonating cord selected according to the expected force required to achieve penetration, and inserted into the guide rail elements (103). The detonating cord is passed through the grommet (109) of the filler end cap 106 and the cap assembled to the carrier body (101), for example by the use of a suitable adhesive.

The carrier body can now be filled with a tamping fluid. Optionally, the carrier body (101) may be prepared with a lining of a suitable gelling agent so that when filled, the fluid forms into a gel thus preventing leakage

of the tamping fluid in the event of accidental fracturing of the carrier body. When detonated, the charge on the loading card, explosively accelerates the tamping fluid through the carrier body and into the target.

The effectiveness of the penetrating operation of the second charge carrier embodiment may be enhanced by the placement of a flexible frangible cutting sheet in front of the detonating cords, or alternatively, replacing the detonating cord with a flexible frangible explosive cutting sheet.

This second embodiment of a charge carrier according to the invention described above is particularly suited to the forced entry of doorways where there is a perceived asymmetry of strength in the door structure. Thus for example in a roller door situation, the charge is effective in urging that side of the door from its guide rail when the carrier body is aligned adjacent to an edge of the roller door.

The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the invention.

CLAIMS

1. An elongate explosive charge element, said explosive charge element including a flexible frangible cutting sheet, said charge element adapted to the penetration of a barrier structure.

2. The charge element of claim 1 wherein said cutting sheet is comprised of a matrix of polymers including plasticisers, stabilizers and flexible agents, said matrix containing a substantially uniform distribution of powdered material.

3. The charge element of claim 1 wherein said powdered material is selected singly or in combination from a group of metals and ceramics, said group of metals including copper, aluminium, brass and ferrous metals.

4. The charge element of claim 2 wherein said cutting sheet is formed by an extrusion process.

5. The charge element of claim 2 wherein said cutting sheet is formed by a casting process.

6. The charge element of claim 1 wherein said cutting sheet is associated with an explosive agent.

7. The charge element of claim 6 wherein said explosive agent is in sheet form laminated to said cutting

sheet, the lamination comprising an explosive agent layer and a first cutting sheet layer.

8. The charge element of claim 7 wherein said lamination of said cutting sheet and said explosive agent layer are formed so as to produce a shaped charge effect when combined with a stand-off material; said charge effect having the general behavioral characteristics of the "Monroe Effect".

9. The charge element of claim 8 wherein said lamination of said first cutting sheet and said explosive agent layer is combined with a second layer of cutting sheet so as to substantially envelop said explosive agent layer and said first cutting sheet; said second layer acting as a tamping layer.

10. An elongate explosive charge element, said explosive charge element including a flexible frangible explosive cutting sheet, said charge element adapted to the penetration of a barrier structure.

11. The charge element of claim 10 wherein said explosive cutting sheet is comprised of a matrix of polymers including plasticisers, stabilizers and flexible agents, said matrix containing a substantially uniform distribution of powdered

material, said matrix further containing a distribution of explosive agent.

12. The charge element of claim 11 wherein said powdered material is selected singly or in combination from a group of metals and ceramics, said group of metals including copper, aluminium, brass and ferrous metals.

13. The charge element of claim 11 wherein said explosive cutting sheet is formed by an extrusion process.

14. The charge element of claim 11 wherein said explosive cutting sheet is formed by a casting process.

15. The charge element of claim 14 wherein said explosive cutting sheet is formed so as to produce a shaped charge effect when combined with a stand-off material; said charge effect having the general behavioral characteristics of the "Monroe Effect".

16. The charge element of claims 2 and 15 wherein said explosive cutting sheet and said stand-off material is combined with a layer of flexible frangible cutting sheet, said flexible frangible cutting sheet acting as a tamping layer.

17. The charge element of any of claims 1 to 16 wherein said charge element is provided with a metal liner.

18. The charge element of claim 17 wherein said metal liner is combined with laminations of said flexible frangible cutting sheet and said explosive agent; said metal liner acting a penetrating agent; said cutting sheet acting as a tamping agent.

19. The charge element of claim 18 wherein said laminations of said cutting sheet, said explosive agent and said liner, when combined with a stand-off material act as a shaped charge with the behavioral characteristics of the "Monroe Effect".

20. The charge element of claim 17 wherein said metal liner is combined with laminations of said flexible frangible explosive cutting sheet; said metal liner acting as a penetrating agent; said explosive cutting sheet acting as a tamping agent.

21. A charge carrier adapted to support elongate explosive charge elements, said charge carrier adapted to the penetration of a masonry wall.

22. The charge carrier of claim 21 wherein said carrier is comprised of a frame having a generally rectangular perimeter and at least one cross member,

the members of said frame and cross member formed of hollow section polymeric material.

23. The charge carrier of claim 22 wherein said frame members have an outer face provided with a channel extending the length of said members; said channel adapted to accept said elongate explosive charge element as an insert.

24. The charge carrier of claim 23 wherein said frame perimeter and said cross member form a sealed container adapted for the retention of a tamping fluid; said sealed container provided with apertures and closure means for the filling of said tamping fluid.

25. The charge carrier of claim 24 wherein the internal surfaces of said sealed container are pre-coated with a gelling agent adapted to modify said tamping fluid into a tamping gel when said fluid is added to said container.

26. The charge carrier of claim 25 wherein said frame is provided with foot elements adapted to provide a height adjustment facility to said perimeter frame.

27. The charge carrier of claim 26 wherein said frame is provided with an adjustable hinged support brace,

said brace attaching to the rear face of a cross member.

28. The charge carrier of claim 27 wherein said frame is provided with a plurality of charge ports on the rear face of said frame members.

29. The charge carrier of claim 21 wherein said elongate explosive charge element is a composite layered and shaped assembly of flexible frangible cutting sheet and an explosive agent.

30. The charge carrier of claim 21 wherein said elongate explosive charge element is a composite layered and shaped assembly of flexible frangible explosive cutting sheet and an explosive agent.

31. The charge carrier of claim 29 and claim 30 wherein said explosive charge element includes a shaped metal liner.

32. A charge carrier adapted to support an elongate explosive charge element adapted to effect a directed explosive charge for the penetration of a barrier in which the penetrating agent is a fluid.

33. The charge carrier of claim 32 wherein said barrier is comprised of structures including domestic and commercial metal roller doors, metal doors, fire doors, reinforced timber doors and glass doors.

34. The charge carrier of claim 32 wherein said carrier is comprised of an elongate body of hollow section polymeric material.

35. The charge carrier of claim 34 wherein said elongate body is provided with a sealing end cap at a first end and filler end cap at a second end.

36. The charge carrier of claim 35 wherein said filler end cap is provided with an aperture and closure means adapted to allow the filling of said body with a tamping fluid.

37. The charge carrier of claim 36 wherein said filler end cap is provided with a detonating cord grommet.

38. the charge carrier of claim 37 wherein the internal walls of said body are pre-coated with a gelling agent adapted to modify said tamping fluid into a tamping gel when said fluid is added to said body.

39. The charge carrier of claim 38 wherein said elongate body is provided with an adjustable foot element adapted to provide a height adjustment facility to said body.

40. The charge carrier of claim 39 wherein said elongate body is provided with an adjustable hinged brace.

41. The charge carrier of claim 40 wherein said body is provided with flexible magnetic strips disposed

along portions of the front face of said body, said strips adapted to attach said charge carrier to a ferrous metal surface.

42. The charge carrier of claim 41 wherein said elongate body is provided with internal guide rails adapted to accept a loading card as a friction sliding fit.

43. The charge carrier of claim 42 wherein said loading card is an elongate polymeric extrusion having front and rear wall elements separated by transverse dividing elements so as to form a number of longitudinal passages through the length of said card.

44. The charge carrier of claim 43 in which said loading card is provided with a series of slots and holes disposed at each end of said card adapted to accept and retain a winding of detonating cord laid along the front face of said card so as to form an explosive charge element.

45. The charge carrier of claim 44 wherein said explosive charge element is combined with a flexible frangible cutting sheet.

46. The charge carrier of claim 45 wherein said explosive charge element comprises a frangible

cutting sheet, the matrix of said cutting sheet containing a distributed explosive agent.

47. A method for the penetration of a barrier structure, said method including the steps of,

a. forming a flexible frangible cutting sheet by a process of extruding or casting in a suitable mould, a mixture of polymers including plasticisers, stabilizers, flexible agents and powdered metal or ceramics,

b. shaping said cutting sheet in combination with a layer of explosive agent and a stand-off material to form an elongate explosive charge element,

c. placing said explosive charge element in contact with said barrier structure and detonating said explosive charge element.

48. A method for the penetration of a barrier structure, said method including the steps of.

a. forming a flexible frangible explosive cutting sheet by a process of extruding or casting in a suitable mould, a mixture of polymers including plasticisers, stabilizers and flexible agents, powdered metal or ceramics and an explosive agent,

b. shaping said explosive cutting sheet and combining said sheet with a stand-off material to form an elongate explosive charge element,

c. placing said explosive charge element in contact with said barrier structure and detonating said explosive charge element.

49. A method for the penetration of a barrier structure using a charge carrier, said method including the steps of,

a. installing an elongate explosive charge element in said charge carrier,

b. filling said charge carrier with a tamping agent,

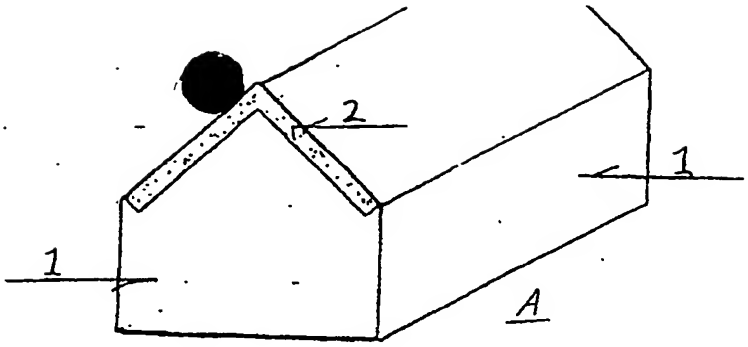
c. placing said charge carrier in contact with said barrier structure and detonating said explosive charge.

Dated 28 November 2002

Scott Allman, James Sammons & Chris Murry

By their Patent Attorneys

Wallington-Dummer



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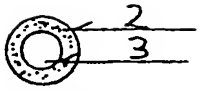

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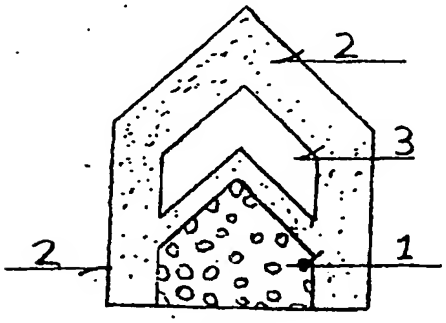

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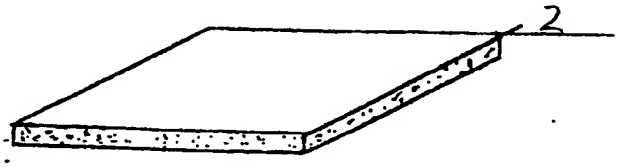

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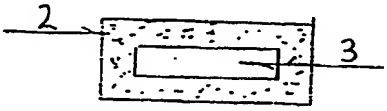

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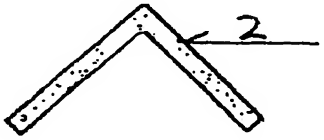

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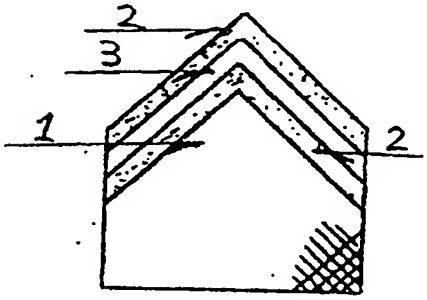

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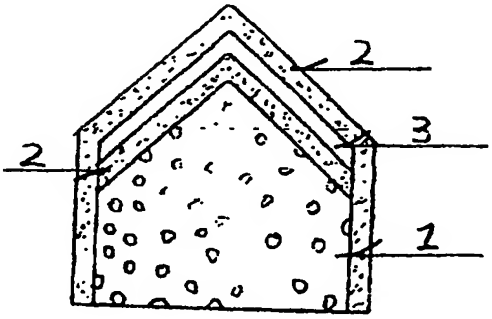

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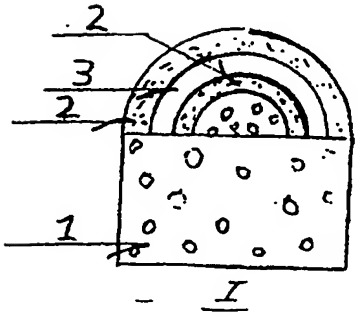

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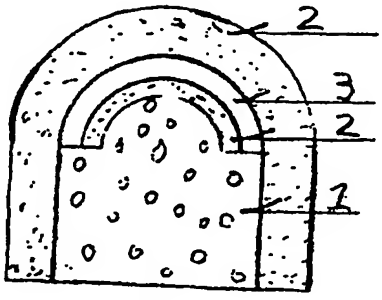

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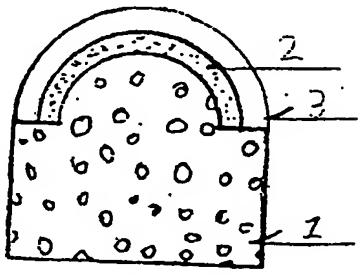

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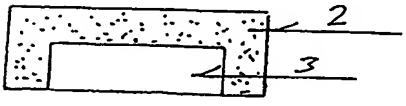
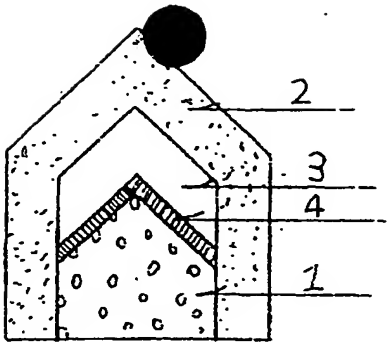


L

Fig. 1



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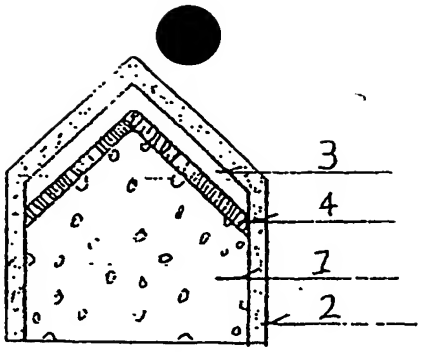

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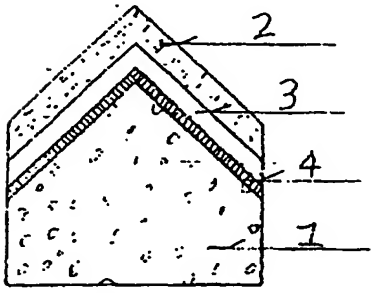

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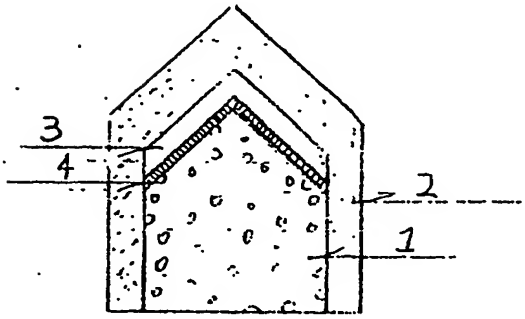

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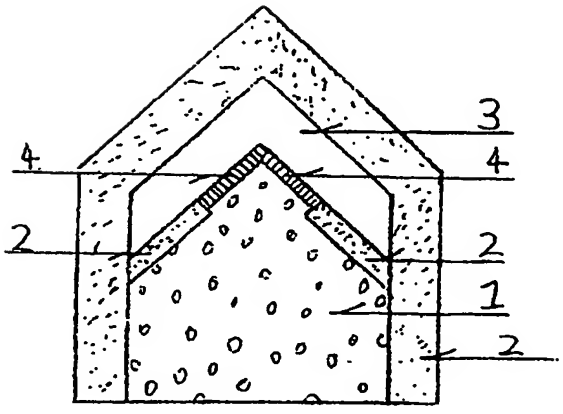

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Fig. 2

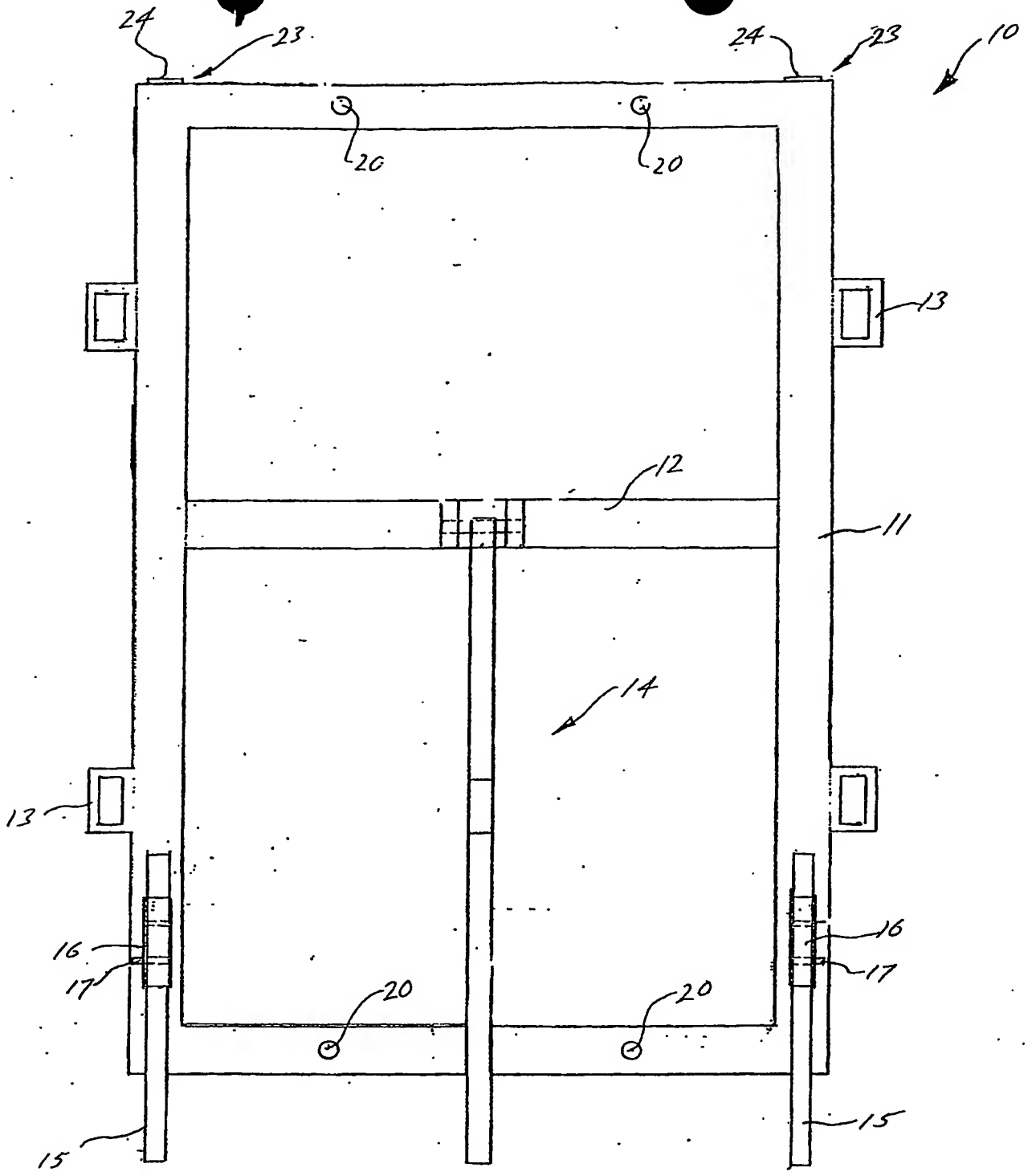

Fig. 3

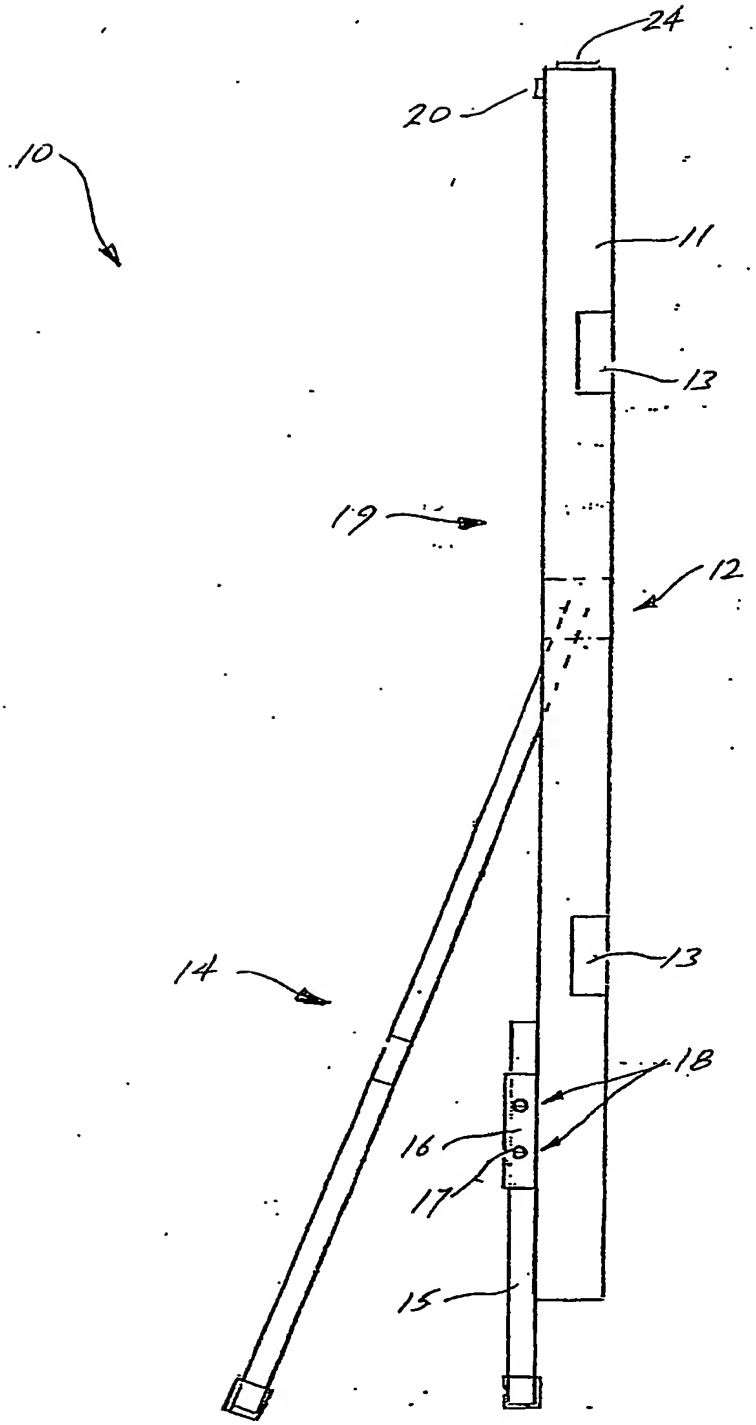

Fig. 4

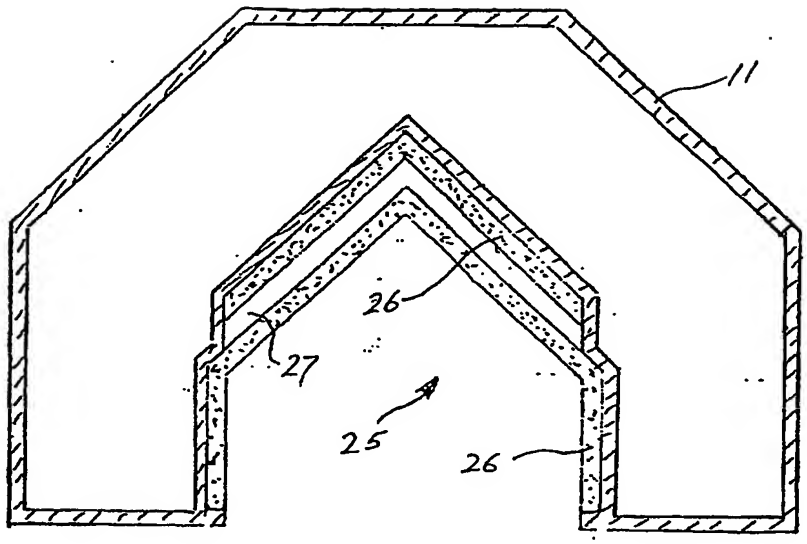

Fig. 6

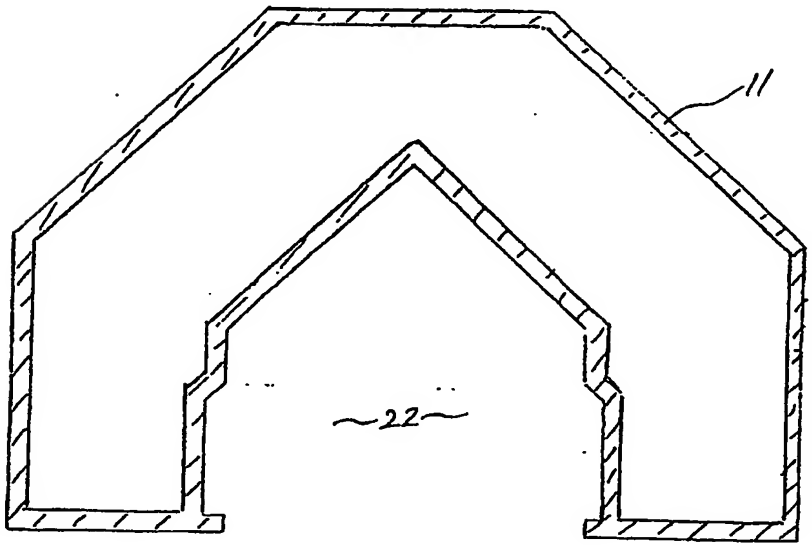

Fig. 5

21

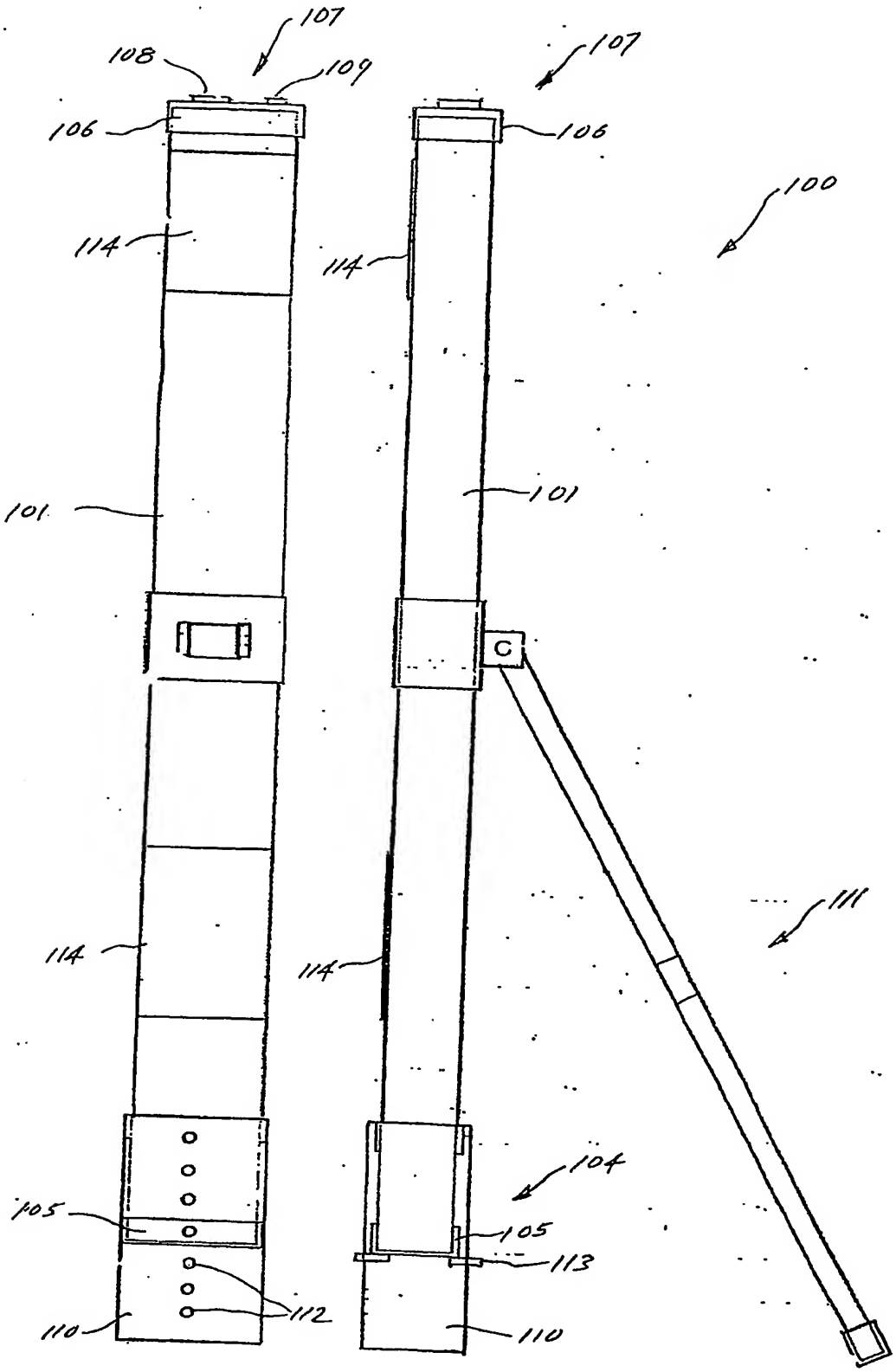
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Fig. 7

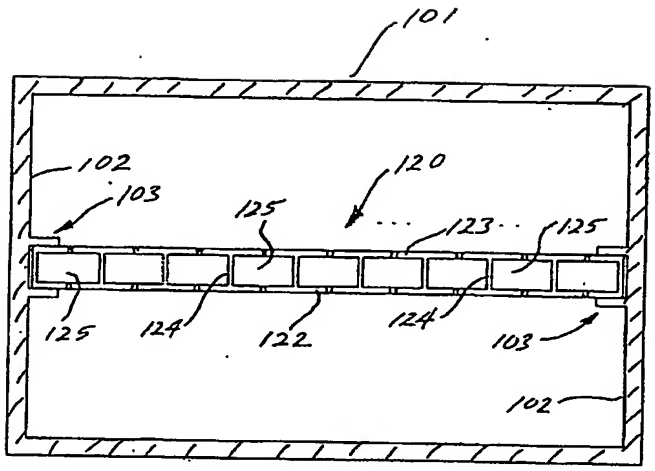

Fig. 8

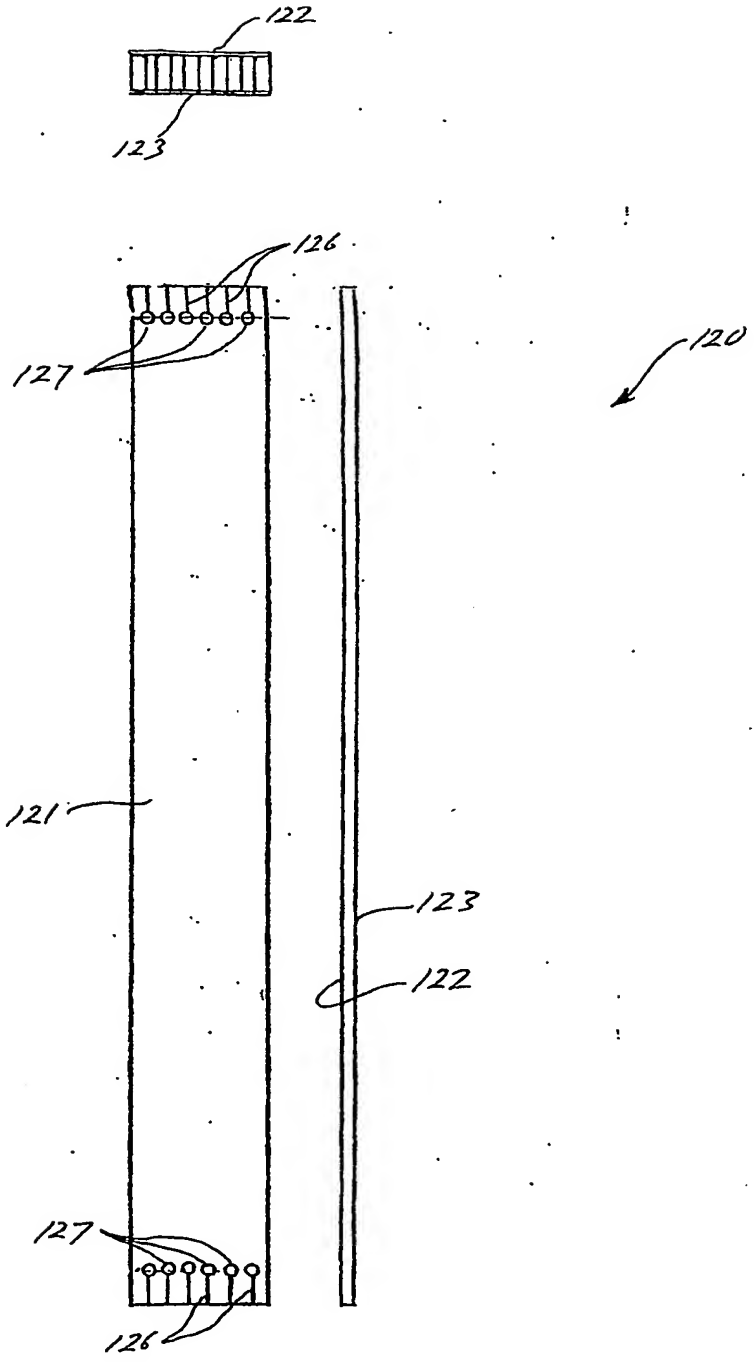

Fig. 9

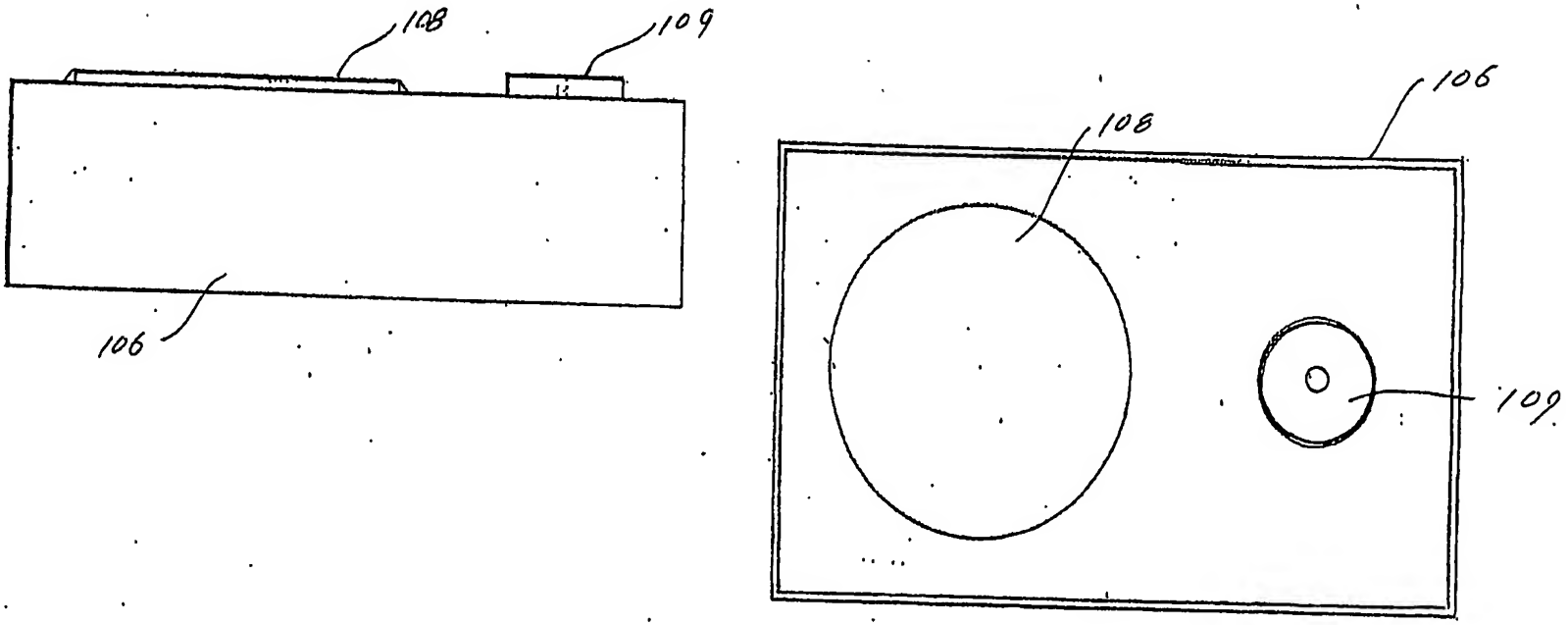

Fig. 10